



# Intel Innovation:

## “Wireless-Internet on-a-Chip” Technology

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Technology and Manufacturing Group

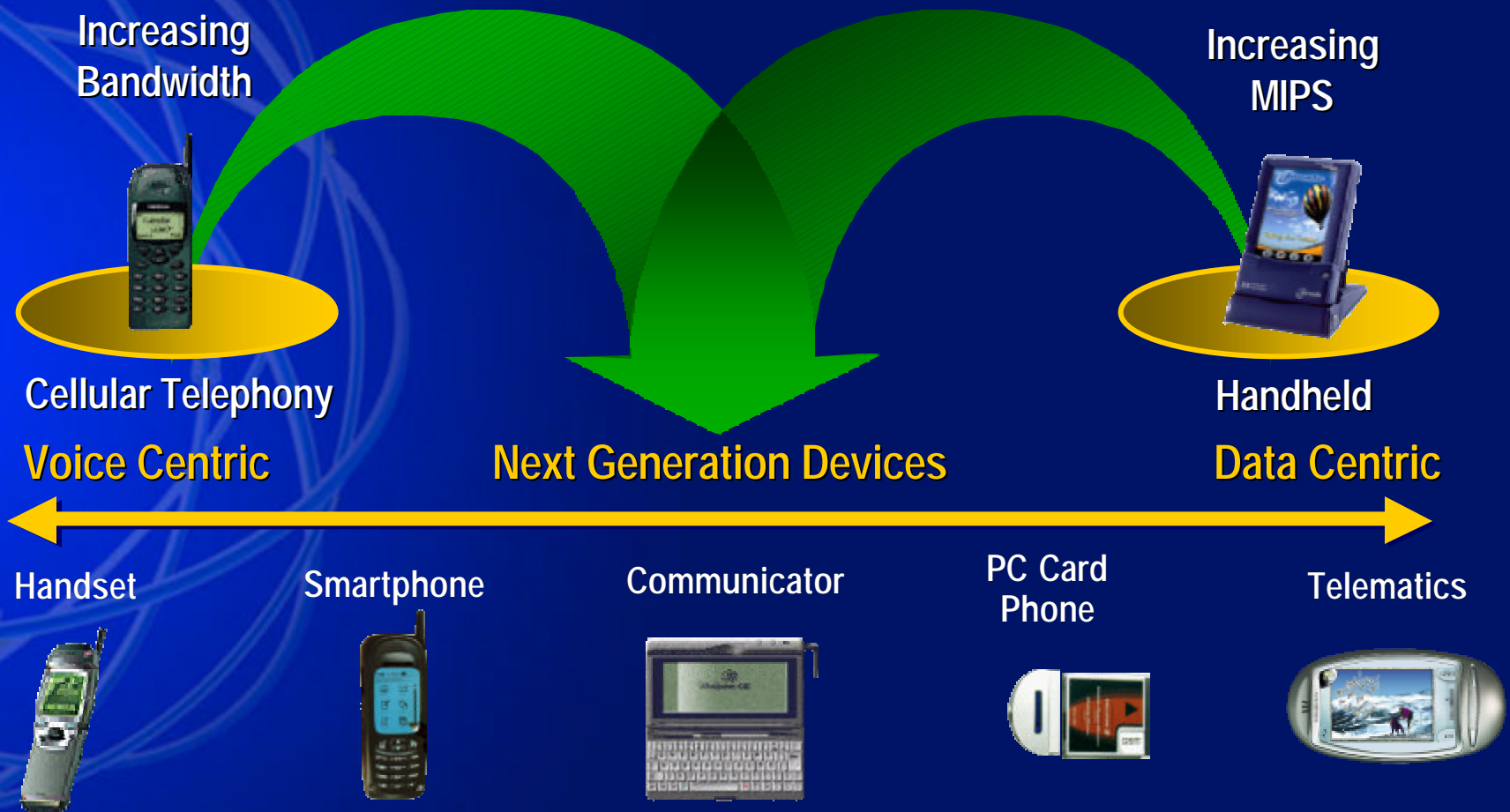
**Dennis Sheehan**, Director of Marketing,  
Cellular Communications Division

# What we're announcing

## "Wireless-Internet-on-a-Chip" A new Silicon Process Technology

- Combines the core components of today's cell phones and handheld computers onto a single chip.
- Intel has cost effectively integrated it's leadership flash, logic and analog technologies – without compromising performance or density – onto a single chip using one manufacturing process.
- Chips produced on the new process may be up to five times more powerful than today's wireless devices.

# Convergence of voice + data



# Intel's Wireless Personal Internet Client Architecture: PCA

- PCA Silicon hardware building blocks meeting the convergence needs of voice + data.
- Building Blocks: Compute, Communications and Memory
  - Silicon Processing: Some common process technology steps, common fabrication facility, separate wafers.



## Compute

Intel® XScale™  
Microarchitecture

## Communications

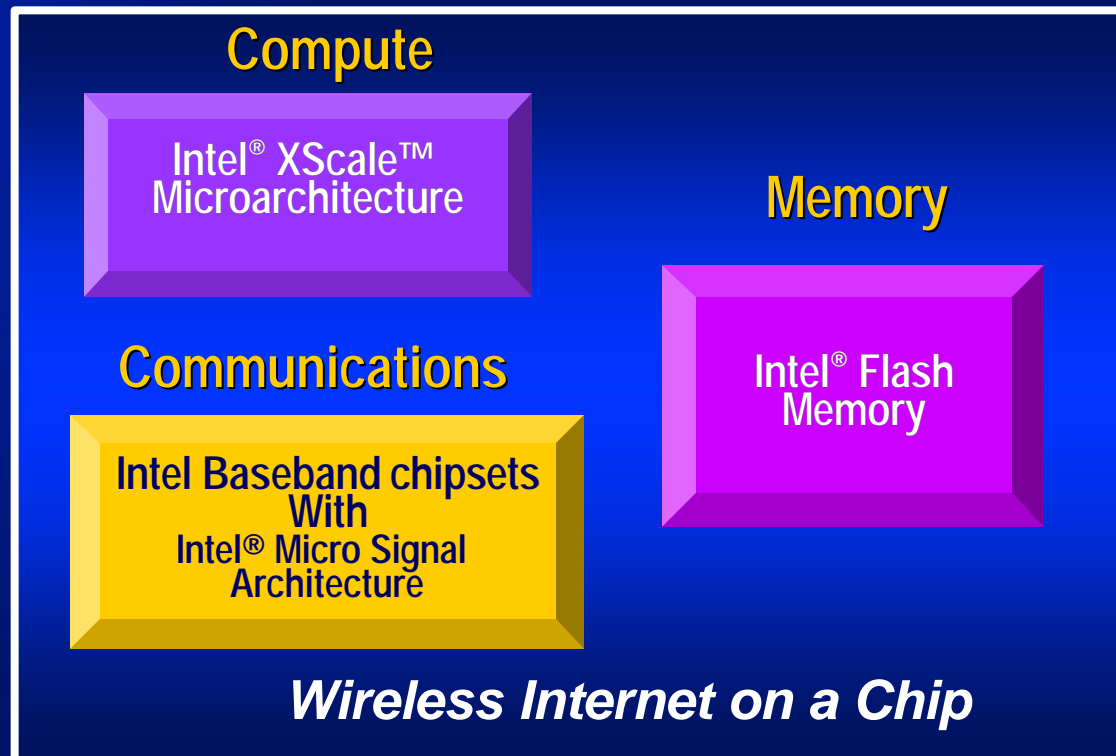
Intel Baseband chipsets  
With  
Intel® Micro Signal  
Architecture

## Memory

Intel® Flash  
Memory

# "Wireless-Internet-on-a-Chip" Technology

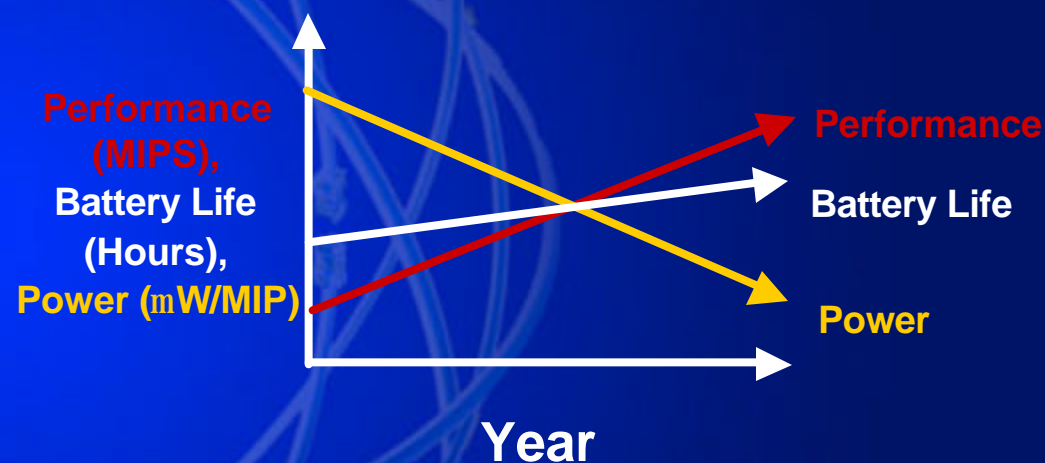
- Intel is able to integrate it's leadership logic, flash and analog silicon technologies onto the same silicon, without compromising performance or density, providing leadership "System-on-a-Chip" capabilities.
  - Silicon Processing: Exact same process technology steps, same fabrication facility, same wafer → leadership integrated components.





# Silicon Integration Leadership

## Converged Voice + Data Requirements Trend



## Flash + Logic + Analog Integration

High Performance with Memory & Compute Integration

Low Power with elimination of external busses

Improved MIPS/mW → Longer Battery Life

Small form factor & improved reliability with fewer components

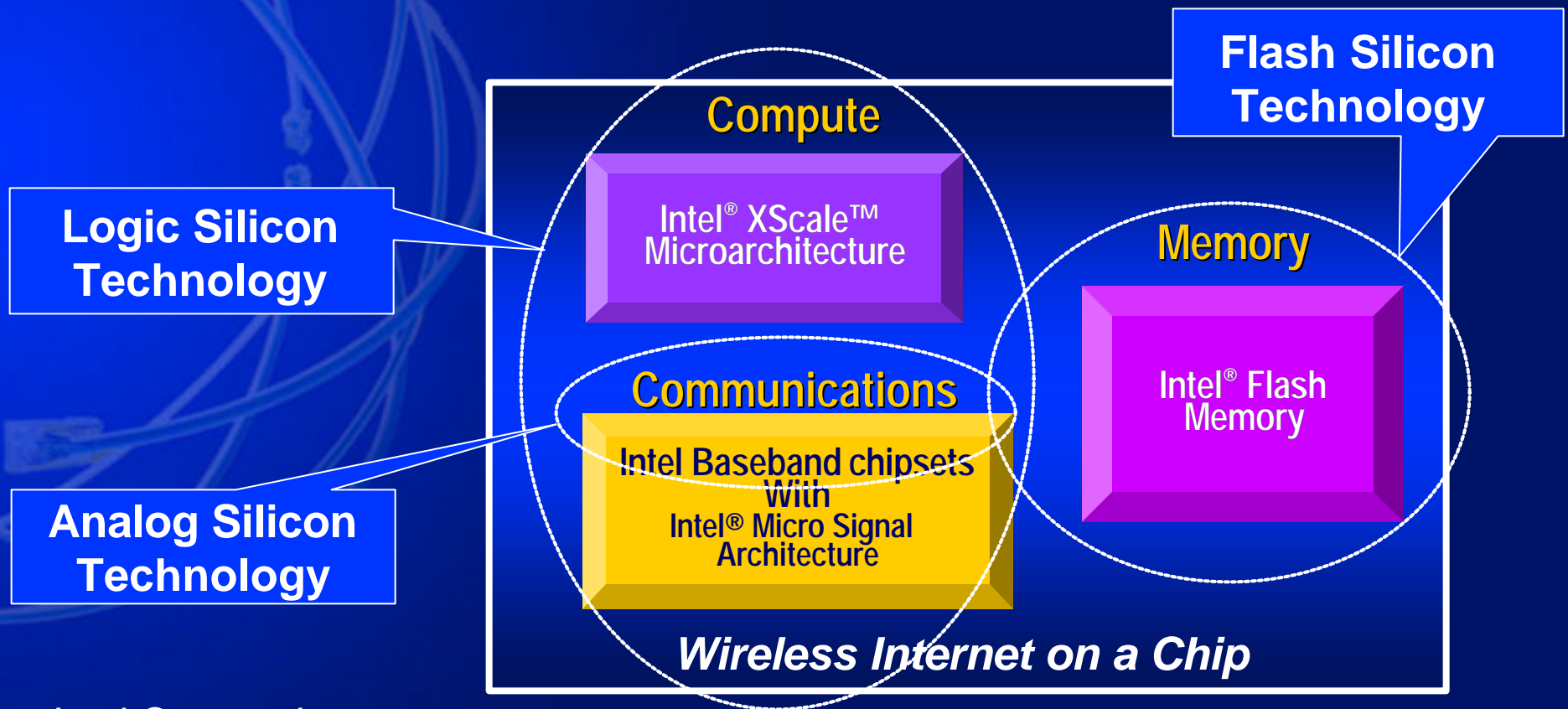
- Intel is continuing its focus on the growing wireless client markets by providing innovative silicon process technologies.

# What it means for users

- Products built on the “Wireless-Internet-on-a-chip” technology will one day be capable of operating at several times more performance with several weeks more battery life than today’s devices.
- Applications in their infancy today will accelerate to reality
  - “Wearable” devices -- Star Trek-like communicators, Dick Tracy watch phone.
  - One device that can search and make restaurant reservations; check the day’s specials; help locate available parking; view movie trailers; and check on the sitter.
  - On the fly, multiparty video conferencing, enhanced e-business, voice-activated calendaring and e-mail.
  - Remote health analysis and treatment.
- Fact: In 1984, Motorola’s first cell phone handset series, called the Dyna-TAC 8000X, was introduced. It weighed two pounds and cost more than \$3,995. Today, the average cellular handset weighs a few ounces, costs approximately \$100 to \$200 and fits in a person’s palm.

# Compute, Communications and Memory Integration: Intel Core Silicon Technology Strengths

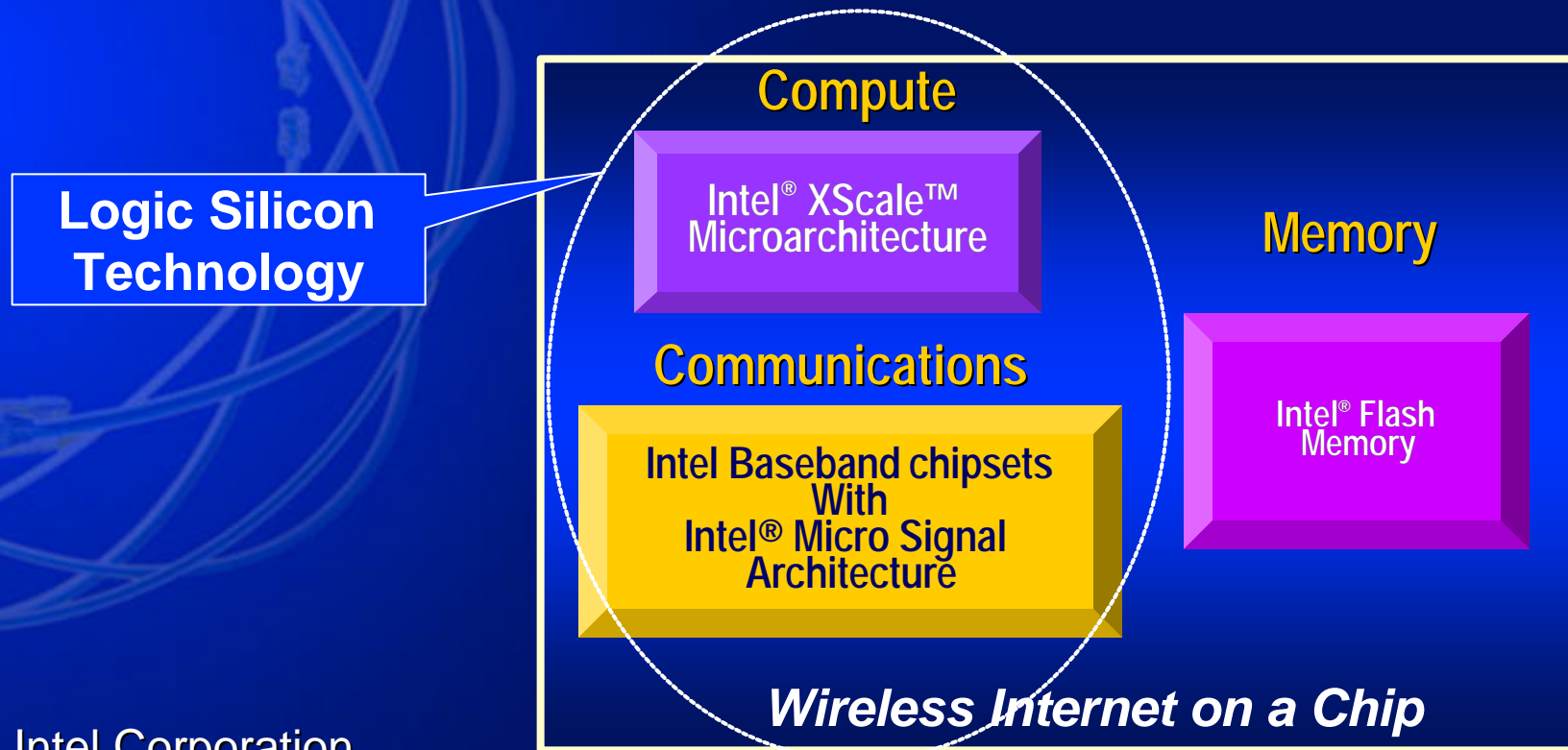
- Industry leaders in flash + Industry leaders in logic = Industry highest performing integrated silicon.





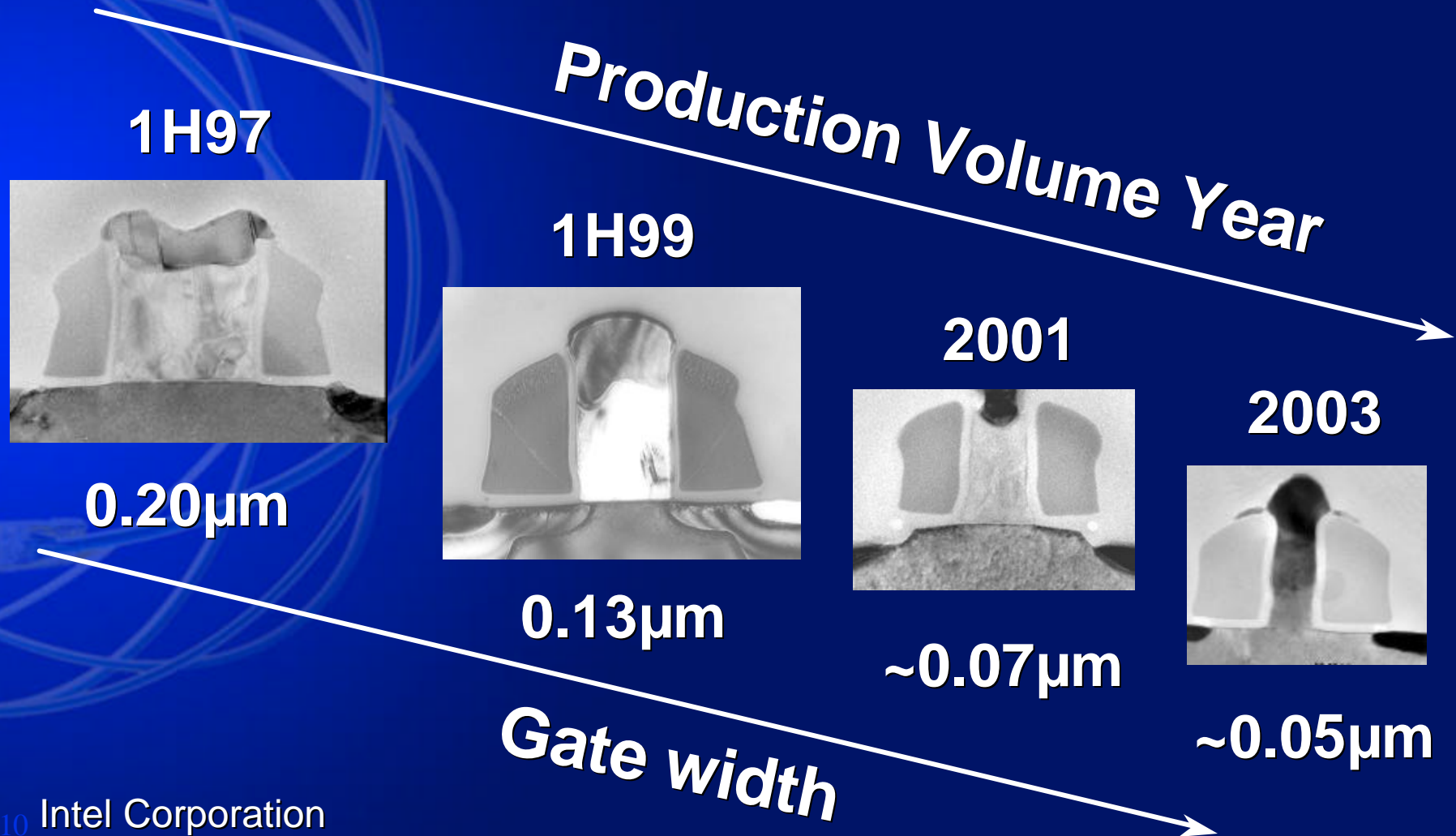
# Silicon Integration Leadership

- Intel's logic process technologies features the world's fastest transistor used in volume production. Intel transistors are the foundation of the industry's fastest microprocessors.
  - Provides industry-leading transistor performance at lower operating voltage
  - Low Voltage = Low Power, Key to Battery Operated Devices



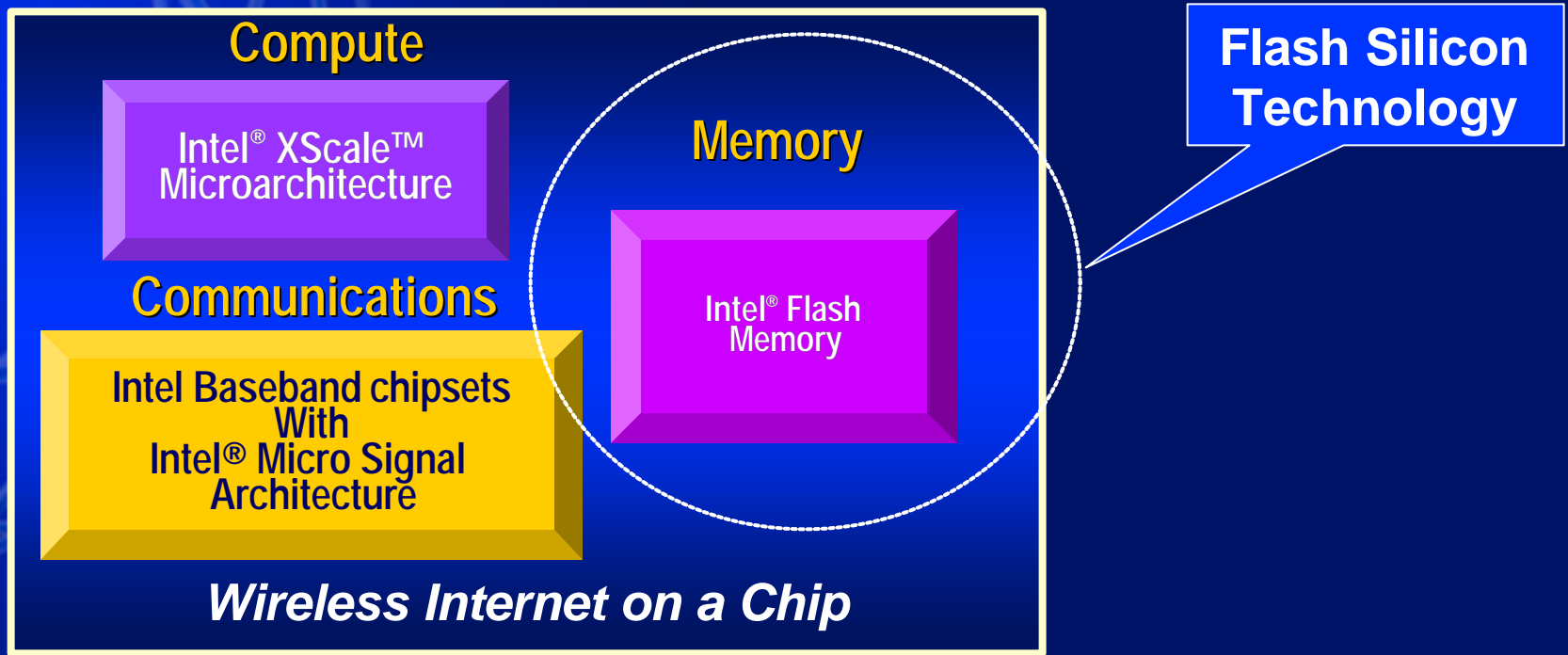
# Logic Technology Scaling

- Driving Moore's Law
- Transistor Performance Leadership



# Silicon Integration Leadership

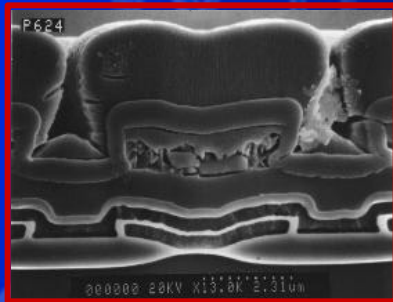
- Intel's Flash Memory Technology features the smallest NOR flash memory cell & the industry's most advanced lithography.
- Intel StrataFlash™ Memory Multi-Level-Cell Technology Innovation stores multiple logical bits in each physical memory cell.



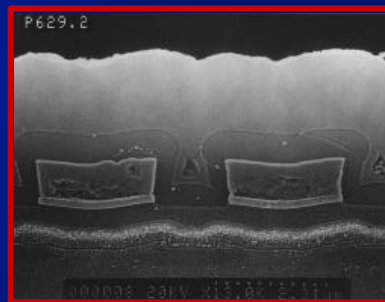
# Flash Technology Scaling

- 15 years and 7 Generations of Leadership
    - Intel StrataFlash™ Memory in Volume Since 1997
    - Starting at 0.25μ, all Intel Flash Technologies developed synergistic with same generation Logic Technology
      - Synergy driven at both factory and technology architecture levels
        - Allows flexibility to run Flash and Logic in the same factory
        - Leverages development resources and factory capacity
- ➔ **Initiated integration learning of leadership Flash and Logic**

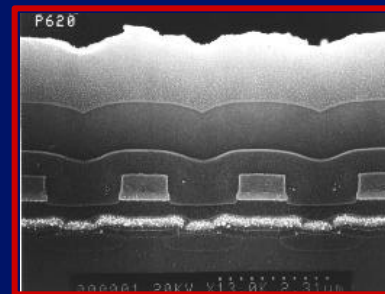
1986 / 1.5μ



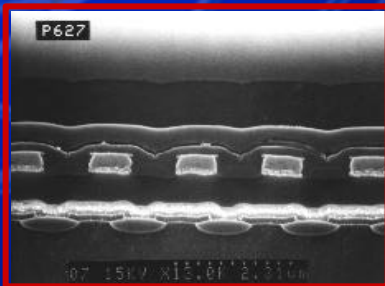
1988 / 1.0μ



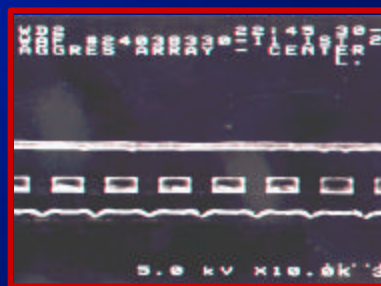
1991 / 0.8μ



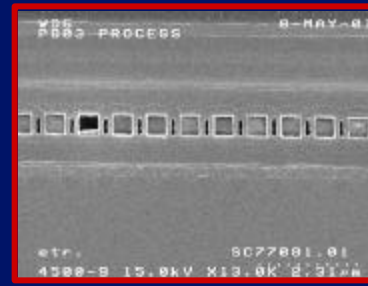
1993 / 0.6μ



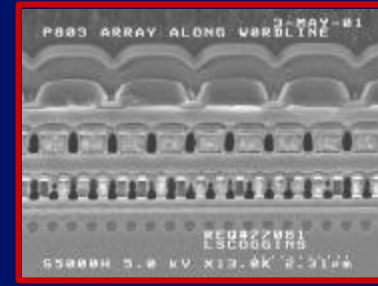
1996 / 0.4μ



1998 / 0.25μ



2000 / 0.18μ

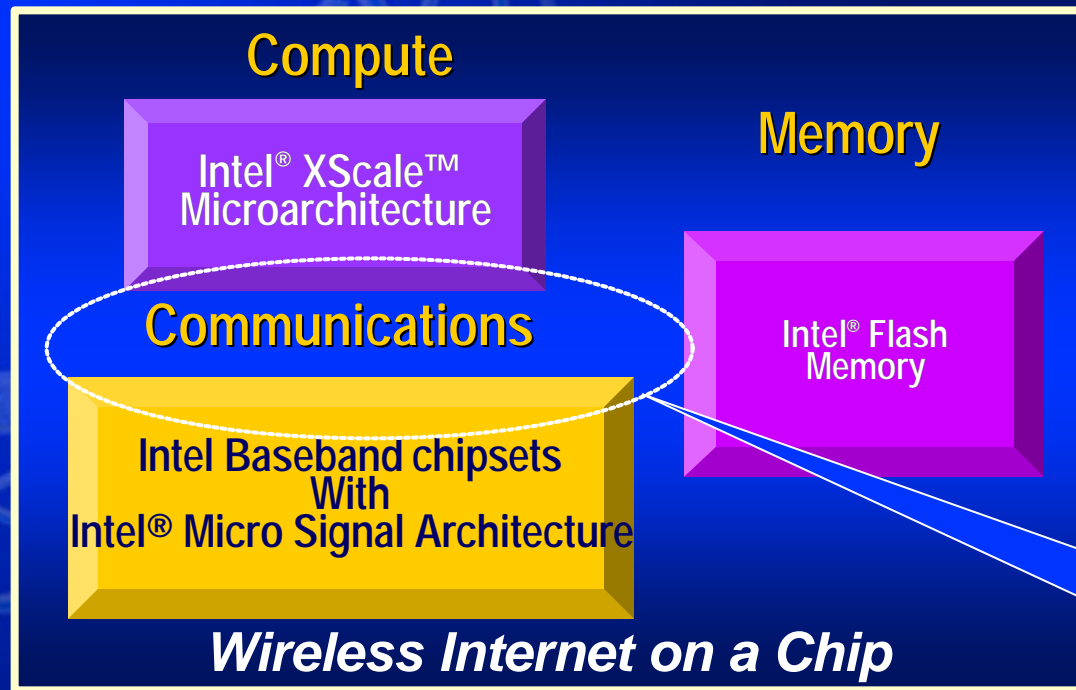
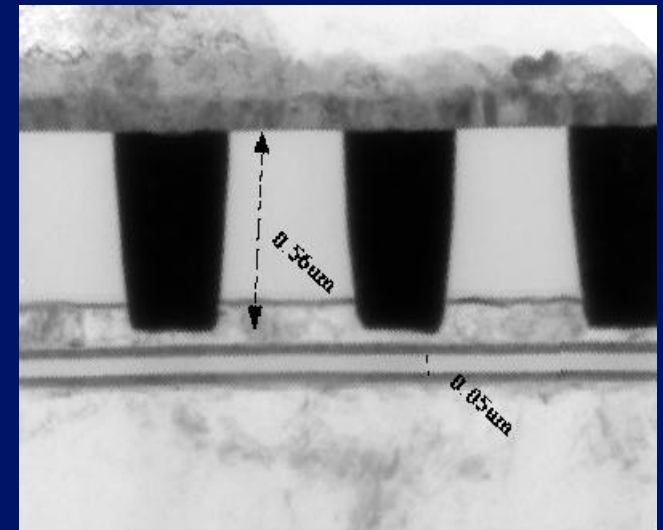




# Silicon Integration Leadership

- Analog elements: simple additions to a flash/logic base technology.
  - Triple Well for noise isolation → Flash base
  - 3Volt Transistor → Flash base
  - Precision passives:

**Metal-Insulator-Metal  
Precision Analog Capacitor →**



**Analog Silicon  
Technology**



# "Wireless Internet on a Chip"

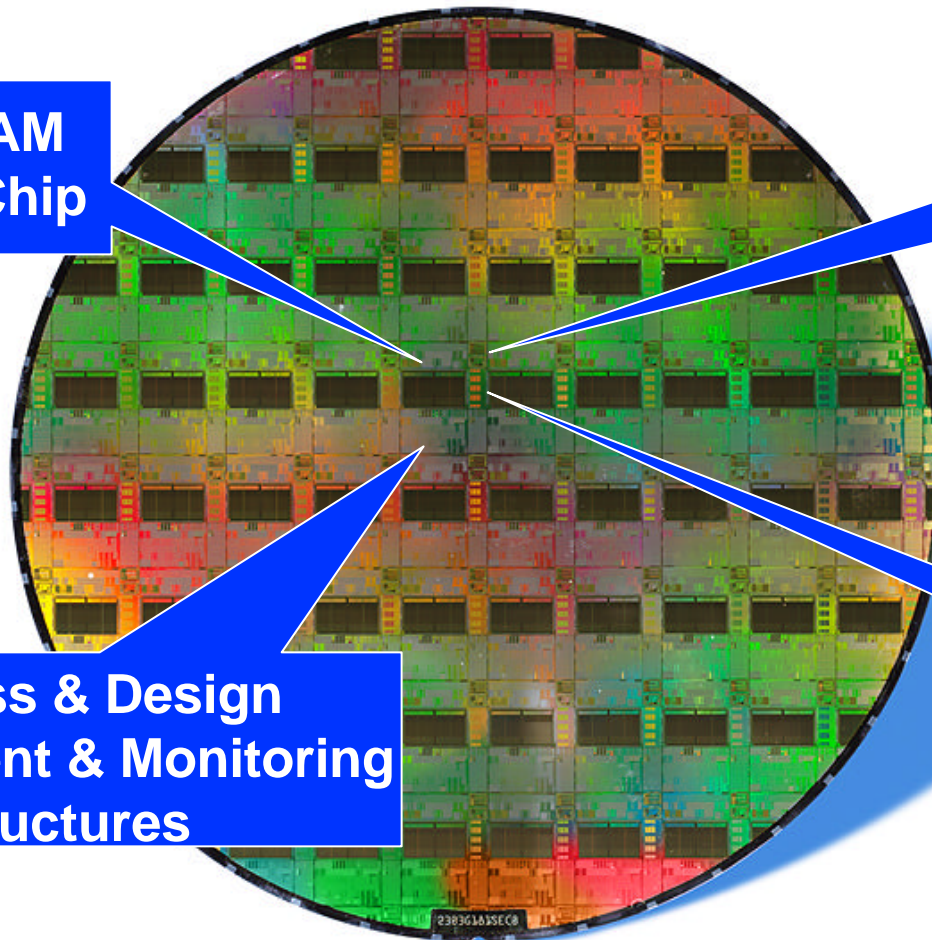
- Leadership Integrated Flash + Logic + Analog TestChips
- Ability to move complex technologies into volume production.
  - Shipped one billion flash products; second billion expected by 2002.
  - Currently shipping ~four Microprocessors every second; 24/7/365.

**Logic / SRAM  
Yield Test Chip**

**Analog Yield  
Test Chip**

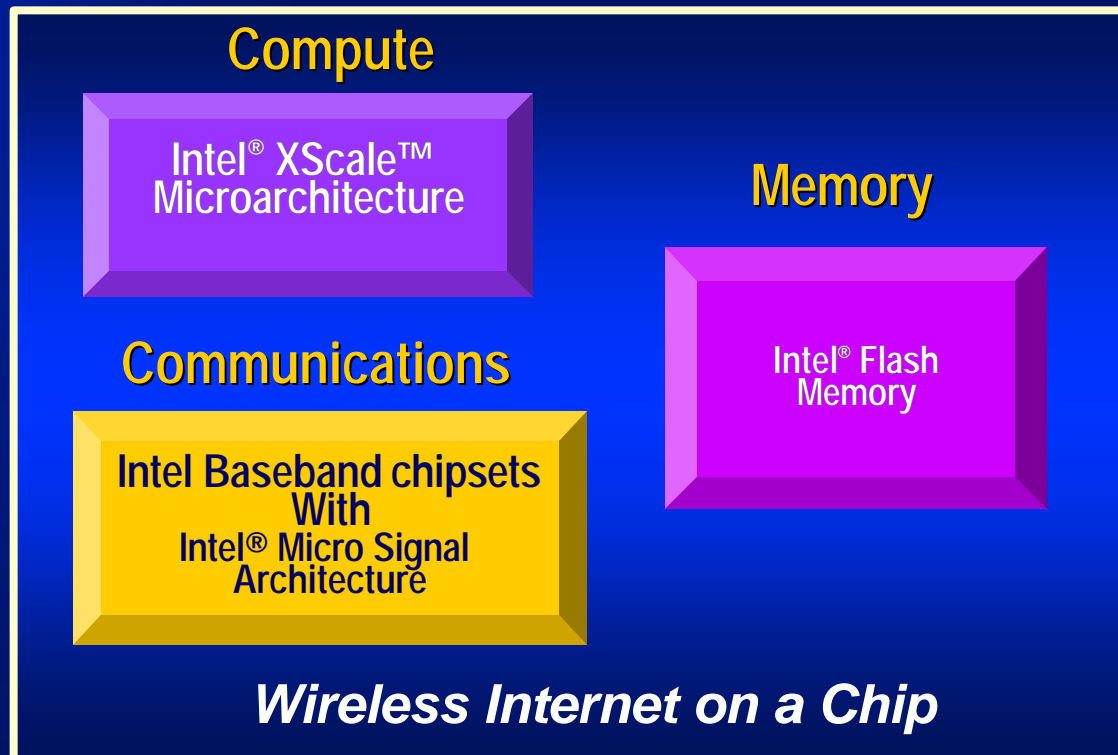
**Process & Design  
Development & Monitoring  
Structures**

**Flash Yield  
Test Chip**



# "Wireless Internet on a Chip" Technology

- Industry leaders in flash + Industry leaders in logic = Industry highest performing integrated silicon.
- Technology to be deployed at 0.13μ.
- Process architecture modularity provides a "platform" technology enabling products to combine Flash, Logic or Analog functions in a variety of combinations.



# Summary

- Intel has achieved a significant milestone in manufacturing process technology by combining the core components of today's cell phones and handheld computers onto a single chip.
- Intel has cost effectively integrated its leadership flash, logic and analog technologies – without compromising performance or density – onto a single chip using one manufacturing process.
- The wireless-Internet-on-a-chip technology is expected to bring a range of devices and a host of futuristic wireless applications to reality.